

## **APPENDIX A**

***Regulatory Investigation of the Potential  
Airborne Release of Radionuclides  
During the May 14, 1997  
Explosion in the Plutonium Reclamation Facility  
at Hanford***

**Prepared By**

**Washington Department of Health  
Division of Radiation Protection  
Air Emissions & Defense Waste Section**

**REGULATORY INVESTIGATION OF THE POTENTIAL AIRBORNE  
RELEASE OF RADIONUCLIDES  
DURING THE MAY 14, 1997 EXPLOSION  
IN THE  
PLUTONIUM RECLAMATION FACILITY AT HANFORD**

by the  
Washington State Department of Health  
Division of Radiation Protection  
Air Emissions & Defense Waste Section

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## **INTRODUCTION**

At approximately 8:00 p.m. on May 14, 1997, an explosion occurred in Room 40 (the chemical make-up room) on the fourth floor of the Plutonium Reclamation Facility (PRF). The explosion destroyed a tank containing hydroxylamine nitrate and nitric acid, causing a breach in the roof of the building and sending a visible cloud of gases out the main stack of the Plutonium Finishing Plant (PFP). Although the room where the explosion occurred was not used for the storage of plutonium, past contamination incidents had occurred there, leaving unknown levels of fixed plutonium contamination.

The facility declared an Alert (an Alert is the lowest level emergency classification in the U.S. Department of Energy's emergency response program). The Department of Health (Department), as the lead response agency for radiological emergencies in Washington State, was notified at approximately 12:00 a.m. on May 15, more than four hours after the explosion occurred. The Alert notification included information that the prognosis was unknown at the time, and that a water line was ruptured, allowing water to flow down and out of the PRF to the surrounding environment. We later learned that the force of the explosion breached the roof of the building. Part of the notification received by the Department of Health was that no radioactivity was involved. Nine workers were allegedly exposed to chemicals from the release.

The Department's initial response to the emergency was based on the assumption that plutonium could have escaped to the atmosphere. Based on institutional memory of that facility, we recognized that although room 40 had not been used for storing plutonium, past contamination incidents had occurred there. The explosion could have knocked contamination loose in the room, resulting in emissions of plutonium isotopes through the main stack (291-Z-1) of PFP (which exhausts PRF), or through the breach in the roof of

PRF. The Department responded with two field teams, and by sending representatives to the Unified Dose Assessment Center (UDAC) at the Federal Building, in Richland and to the state EOC in Olympia.

At 6:41 a.m., on May 15, 1997, the Alert was lifted. At that time, the issues for the Department were to:

1. confirm that no plutonium or other radionuclides were released to the atmosphere;
2. determine whether there were any violations of the federal or state Clean Air Act for radionuclides under the Department's regulatory program for airborne radionuclides; and
3. evaluate the emergency response process, and implement changes based on lessons learned.

The first two issues are addressed in this report by the Air Emissions & Defense Waste Section. The third issue is covered in Section III of this report.

An independent investigation to verify USDOE's claim that no plutonium escaped the plant during the event was begun, both under the Department's regulatory program, and with the invitation by USDOE headquarters.

This report represents the Department's findings and is not part of the accident investigation being conducted by the USDOE.

## **SCOPE**

The Department of Health is the radiation control agency in the state of Washington, and is the lead response agency for any incident involving the possible release of radioactive material that may affect the public, as well as regulating airborne radionuclides under federal and state authority. Our initial response and follow-up investigation centered solely around the potential for plutonium or other radionuclides to have been released.

*[NOTE: It is important to mention the potentially affected workers when discussing the Department's authority. In private industry, the Department regulates worker exposures to radioactivity. With the Department of Energy, however, the Atomic Energy Act pre-empts that authority for contractor employees. While concerned for these workers, our involvement was, and is, limited to offering recommendations for their care. The Department also has no authority for worker exposures to chemicals.]*

The regulatory investigation was centered on two areas: the facility, and the environment. Facility-specific equipment and data were evaluated to determine if required equipment was operating as designed to detect any release of radioactive materials. This included the following:

- The Continuous Air Monitor (CAM) in the main stack, with alarm capability in the event of elevated releases of plutonium.
- The record sampler in the main stack.
- Differential pressure gauge data, which would indicate that the filtration system was not functional.
- CAMs on the fourth floor of the PRF, where Room 40 is located.
- Fixed head air sampler data in room 40, where the explosion occurred.
- Health Physics Technician (HPT) surveys of the inside of the PRF.
- HPT surveys outside of the PRF at doors and where the water from the broken pipe flowed.
- Sampling equipment on the other floors of the PRF.

The environmental sampling data included the following:

- Four near field air samplers around the PFP (operated by Waste Management Co., a USDOE contractor).
- Six near field samplers (operated by Waste Management Co.) in the area where the plume was projected, if there had been a release.
- Nine air samplers surrounding the commercial low-level waste disposal site (operated by US Ecology), also in the projected plume area.
- As yet unpublished data from a special USDOE study being conducted at the time, on diffuse and fugitive emissions.
- Three Department air samplers located within the projected plume area.
- Numerous grab air and soil samples from Department field teams collected onsite and offsite.
- USDOE field team data.

## RESULTS

## **Facility-Specific Equipment and Data**

There were three potential pathways for airborne radioactivity to escape from PRF:

1. **The Main Stack:** Under normal operations, all of the PRF is exhausted through the main stack at the PFP. Data from the stack CAM did not show any spikes to indicate elevated plutonium or the release of other radionuclides. The differential pressure readings remained normal, indicating that nothing escaped through the HEPA filters associated with the main stack. Alpha counts of the main record sample were consistent with normal operations.

*[NOTE: The plume that was observed has been reported to be primarily nitrous oxides (NO<sub>x</sub>), which are gaseous, and wouldn't be held up by the filters. Any radionuclides associated with PFP and PRF are particulates, so would not necessarily accompany the NO<sub>x</sub>.]*

There were requests by USDOE to analyze the record sample soon after the event. However, as a designated major stack under state and federal regulations, we could not let that sample be treated differently than all other record samples.

2. **The Breach in the PRF Roof:** This was the most likely pathway for a release, if one were to occur. However, the room CAMs, located on the fourth floor in a room adjacent to Room 40, had no increases in alpha activity. All operated before, during, and immediately after the explosion, making these data extremely valuable. The fixed head filters in Room 40 also did not have any detectable alpha contamination on them. The roof was surveyed, with negative results. It would be expected, if a release occurred through this breach, that some residual contamination would remain.
3. **Door 108, into the PFP:** A worker was standing just outside this door, within seconds of entering the PRF, when the explosion occurred. The pressurization flowed down a stairwell and blew door 108 open for several seconds before negative pressure was restored. The worker was surveyed twice that night. The door and area outside the door were surveyed. No contamination was encountered. Health physicists also evaluated 54 CAMs and fixed-head sampling locations elsewhere in the PRF, with the data just being released the week of July 21. Forty-two of the samplers showed slightly elevated plutonium levels. It is believed that these elevated levels are due to residual contamination present in PRF that was shaken loose by the explosion. None of the locations were high enough to cause the CAMs to alarm, nor is there any indication that any contamination escaped from the building. At the sampling locations, the explosion forced the doors shut. Therefore, there was no pathway for this contamination to escape through the air from the PRF. It was not connected to Room 40, where the explosion occurred.

Radiological surveys were conducted all around the building, including where water flowed from Room 40 down the stairwell to the outside. Plutonium contamination was found on concrete pads. The explosion loosened fixed contamination in Room 40, contaminating the water to low levels, which probably added to the pre-existing contamination in the area. However, this does not affect our finding that no airborne contamination was detected escaping from the building.

It should be noted that there were unnecessary and inappropriate delays in obtaining the plant data. WAC 246-247 requires that data be readily available to the Department. USDOE had to be warned of potential regulatory consequences before the data were shared.

### **Environmental and Field Team Data**

The Department operates air surveillance samplers at many locations around the Hanford Site. These are continuous low-flow samplers that are in place to detect subtle changes in the trend of radionuclide concentrations in air, and to detect a sudden spike radioactivity, such as that found following atmospheric testing of nuclear weapons. While detecting very subtle changes in plutonium concentrations is difficult, these samplers provided the best available samples of air from the surrounding environment. They would have been able to detect any increase that would cause significant dose to the offsite public.

Particulate air samples from these samplers and from special field team samples were collected by Department health physicists and sent to the Department's Public Health Laboratory (PHL) in North Seattle. Samples were first analyzed for gross alpha and beta activities, followed by gamma energy analysis. Finally, the samples were dissolved and an isotopic plutonium analysis was conducted.

The initial gross alpha and beta counts were elevated, compared to historical samples. Such elevated counts, however, are typical, since naturally occurring radon progeny are present in the air and are also alpha and beta emitters. Follow-up counts verified that the elevated readings were, in fact, due to radon progeny, and not to manmade radionuclides.

*[NOTE: A rule of thumb estimate is that radon daughters have a combined half-life of about ten hours, compared to a 24,000 year half-life for plutonium 239, making the differentiation between the two easy.]*

No manmade radionuclides were detected in the air samples, including plutonium isotopes. The plutonium analysis was limited by the small sample volume and low-specific activity of plutonium. In order to detect a simple doubling of ambient plutonium concentrations in air, an air filter would have to be counted for almost two years.

While the Department's data cannot verify that no single atom of plutonium was released to the air, they can be used to verify that nothing detectable was released and that any

plutonium released would have been far below that which would cause an offsite impact, especially when used in conjunction with the plant data and information discussed above.

Gross beta, gamma, and plutonium analyses were conducted at the PHL on six special soil samples collected by the Department's field teams. No elevated plutonium was detected. These samples were collected in accordance with standing procedures for soil sampling, which requires taking a one-inch deep sample, limiting the value of the samples for fresh deposition. One lesson learned from this experience was that it would be more useful to collect surface samples from smooth surfaces rather than samples at some depth.

USDOE contractor samples and US Ecology samples were counted for total alpha and beta. All results supported the Department's findings.

## **CONCLUSIONS**

We were fortunate this accident was not worse. USDOE's delay in notifying the response and regulatory agencies could have been disastrous if plutonium or any other radioactive contaminant had been released, such that offsite protective actions would have been required. While this critique fits more in the Emergency Planning Report, it represents a potential problem for the regulatory program as well.

The Department can now concur with USDOE that no measurable plutonium was released to the air. Some may have flowed outside the PRF along with the water from the ruptured line, but that would not have been airborne.

USDOE was too premature in declaring that no radioactivity was released. They thought there was no contamination in the room and did not account for the breach in the roof. Even with their preliminary data, their conclusive announcement should have waited until the next day, at a minimum. Security personnel onsite were wearing particulate respirators as long as six hours after the explosion (noted by our first field team, who went onsite to retrieve their field kits).

The news media were aware of activities before the USDOE notified the Department. In the midst of notifying our responders, we heard announcements over local radio and television.

Due to funding restraints from USDOE, the Department's public health laboratory had not established emergency detection limits for emergency releases of radionuclides from Hanford (emergency detection limits are well established for radionuclides from a commercial reactor accident, which are mostly different from Hanford).

Although USDOE had asked for the Department's help in determining that no plutonium was released, and although the Department has a regulatory right to airborne release data when they are produced, the data were withheld from the Department for over 24 hours.

A threat of formal enforcement action quickly overcame their reluctance and the data were released.